

**REMEDIAL INVESTIGATION / FEASIBILITY STUDY  
SCOPE OF WORK  
LAKE HAVASU AVENUE AND HOLLY AVENUE  
WQARF REGISTRY SITE  
LAKE HAVASU CITY, ARIZONA**



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**ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY (ADEQ)**  
**Water Quality Assurance Revolving Fund (WQARF) Program**

**REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) SCOPE OF WORK**  
**FOR THE LAKE HAVASU AVENUE AND HOLLY AVENUE WQARF SITE**  
**(A.R.S. § 49-287.03(B))**

January 2018

Arizona Revised Statute (A.R.S.) § 49-287.03(B) requires a scope of work be developed for the RI/FS prior to the Department implementing a remedial investigation and feasibility study. The basic elements of this scope of work are detailed under the Arizona Administrative Code (A.A.C.) R18-16-403(B and C) and 406 (A) and 407. The scope of work for an RI/FS shall generally describe the extent of the remedial investigation based upon site-specific conditions and information obtained from the preliminary investigation.

1. Characterization of soil and vadose zone contamination, including identification of sources;
2. Characterization of groundwater contamination, including identification of sources;
3. Characterization of surface water contamination, including identification of sources;
4. Identification of actual and potential human and ecological receptors;
5. Identification of current and reasonably foreseeable uses of waters of the state that have been or are threatened to be impaired;
6. Identification of current and reasonable foreseeable land uses that have been or are threatened to be impaired;
7. Assessment of current risk to public health;
8. Assessment of ecological risk.

The Lake Havasu Ave and Holly Ave site was listed on the Water Quality Assurance Revolving Fund (WQARF) Registry, on December 4, 2017, due to the presence of soil and groundwater contamination. The Lake Havasu Avenue and Holly Avenue WQARF Site (the Site) is located in Lake Havasu City, Arizona, and is generally bounded to the north by Kiowa Boulevard, to the south by Holly Avenue, to the east by San Juan Drive, and to the west by Cactus Wren Drive. The Site is in an urban setting that includes a mixture of commercial businesses, light industrial, warehouse and residential neighborhoods.

Groundwater and soil at the Site is contaminated with tetrachloroethene (PCE), trichloroethene (TCE), 1,1- dichloroethene (1,1-DCE), 1,2- dichloroethane (1,2-DCA), as well as nitrate and hexavalent chromium. TCE and PCE are present in the groundwater at levels that exceed the aquifer water quality standard (AWQS) of 5 micrograms per Liter ( $\mu\text{g/L}$ ). Both 1,1-DCE and 1,2-DCA are breakdown products of PCE and TCE, and are also present in groundwater at levels exceeding the AWQS of 7 and 5  $\mu\text{g/L}$ , respectively. Chromium is present in the groundwater at levels exceeding the AWQS of 0.1 milligrams per Liter ( $\text{mg/L}$ ). Specific regulatory standards have not yet been established for hexavalent chromium. Nitrate is present in the groundwater at levels exceeding the AWQS of 10  $\text{mg/L}$ . Groundwater in this area occurs at depths ranging from 96 to 170 feet below the

ground surface. Based on historic and recent data collected from the Site, the direction of groundwater flow is to the west-northwest.

Historically, the City of Lake Havasu City constructed two infiltration ponds, the former Kiowa Ponds, to the west of the former McCulloch facility. The ponds were a two-cell, unlined percolation and evaporation lagoon systems for wastewater disposal exclusively from the McCulloch's manufacturing activities. Potential soil impacts within the footprint of the ponds have yet to be characterized. As such, the potential for soil impacts associated with the historical discharge of potentially contaminated wastewater to the former Kiowa Ponds has yet to be determined. Characterization of the soils beneath the ponds area is required to adequately assess potential contaminant concentrations and distribution. The City of Lake Havasu has been accepted into the Voluntary Remediation Program (VRP) to evaluate any impacts remaining from the ponds.

The RI/FS field investigations are necessary and technical information is required to evaluate the nature and extent of contamination may vary from this scope of work depending on site-specific conditions. It is anticipated that additional site characterization activities will be necessary to complete the RI/FS reports. In conformance with these requirements, the Department has prepared the following scope of work for the RI/FS.

### **Remedial Investigation**

As required under A.A.C. R18-16-403(B), the scope of work for a remedial investigation shall provide for the preparation of the following, as applicable:

1. Characterization of soil and vadose zone contamination, including identification of sources.

*Passive soil gas surveys were conducted at the site in 1998 and 1999 which determined that the lateral extent of impact had not been delineated. An evaluation will be conducted of existing data to determine where soil and vadose zone data gaps exist. It is anticipated that additional data may be necessary in the plating/machine/die cast shop area, including the basement and ancillary structures associated with plating shop and machining operations. Soil borings and vapor probes will be installed as needed.*

2. Characterization of groundwater contamination, including identification of sources.

*All existing Site groundwater monitor wells will be made functional and rehabilitated if necessary to establish nature and extent of contamination. Initial groundwater samples will be collected from all site monitor wells to determine baseline conditions. Additional groundwater monitor wells will be drilled and installed based upon the baseline groundwater concentrations and groundwater flow directions. It is anticipated that additional groundwater monitor wells may be needed to adequately define the northern contaminant plume boundary and between LHC stand-by production wells and the former Kiowa Ponds. It is also anticipated that vertical profiling of existing groundwater wells both on and off-site to may be necessary to adequately define the horizontal and vertical extent of groundwater impacts.*

3. Characterization of surface water contamination, including identification of sources.

*The City of Lake Havasu City has entered the VRP to characterize potential releases to the Kiowa Ponds. Overflow from Pond #2 discharges into the Kiowa Wash that ultimately drains into Lake Havasu. To adequately characterize the Kiowa Wash, additional samples may be needed near the overflow of Pond #2 and along the Kiowa Wash.*

4. Identification of actual and potential human and ecological receptors.

*The identification of receptors in the RI will allow an assessment of exposure pathways and human health and/or ecological risks that may result from migration of solvents, metals and nitrate present in subsurface soils and groundwater at the Lake Havasu Avenue and Holly Avenue WQARF site. See number 7 below.*

5. Identification of current and reasonably foreseeable uses of waters of the state that have been or are threatened to be impaired.

*A water use study questionnaire will be prepared for submittal to Mohave County, City of Lake Havasu City and water providers in the Site area. Information gathered will be used to develop a water use report and establish future remedial objectives for the site.*

6. Identification of current and reasonable foreseeable land uses that have been or are threatened to be impaired.

*A land use study questionnaire will be prepared for submittal to source property(ies) land owners, owners of non-source property owners that could be affected by the Site contamination and local government land use agencies controlling zoning. Information gathered will be used to develop a land use report and establish future remedial objectives for the site.*

7. Assessment of current risk to public health.

*This assessment may not be a full risk assessment and will at a minimum be an evaluation that includes review of the adequacy of the Ninyo & Moore 2014 Risk Assessment to identify data gaps needing further evaluation for the source area(s) to eliminate exposure risks. Data may be collected as part of the RI to accomplish this review. Additional exposure pathway evaluation will be conducted comparing any previously collected data, soil and soil-gas data collected during the RI from source area investigations, to appropriate standards such as the U.S. EPA Region 9 Screening Levels, Arizona Soil Remediation Levels and Groundwater Protection Levels. Groundwater analytical data collected during the RI from vertical profiling of stand-by production wells in the Lake Havasu City (LHC) north wellfield and monitoring wells will also be compared to appropriate Arizona Aquifer Water Quality Standards. Data collected will be used to develop Remedial Objectives for the Site. Any complete exposure pathways may also require remediation which will be identified in the FS.*

## 8. Assessment of ecological risk.

*A full ecological risk assessment may not be necessary as part of this RI but if conducted the objective is to provide an evaluation of ecological risks that may result from exposure to any solvents, metals and nitrate present in surface and subsurface soils, and groundwater at the Lake Havasu Avenue and Holly Avenue WQARF site.*

## Feasibility Study

The scope of work for the feasibility study shall generally describe the process for conducting the feasibility study as prescribed in A.A.C. R18-16-407, and may specify additional work to be performed taking into account the information gathered in the remedial investigation. The feasibility study is a process to identify a reference remedy and alternative remedies that appear to be capable of achieving remedial objectives and to evaluate them based on the comparison criteria in order to propose a remedy that complies with A.R.S. § 49-282.06.

Information obtained during the remedial investigation will be used to help identify and determine remedial options and alternatives necessary for VOCs, nitrate and  $Cr(VI)$  impacted vadose zone soils, soil gas and groundwater at the Site that will achieve the remedial objectives determined in the RI. The feasibility study will include an evaluation of the distribution and effectiveness of the calcium polysulfide ( $CaS_x$ ) treatment previously conducted at the site and/or the lateral and vertical extent of remaining dissolved chromium and  $Cr(VI)$  contamination in the previously treated areas of the plating shop.

